RESEARCH MANAGEMENT DIVISION

REVIEW

FOR THE FISCAL YEAR 1986/87

RESEARCH MANAGEMENT DIVISION

Alberta Environment

89-00503/1

This report may be cited as:

Watson, C.E., ed. 1987. Research Management Division review for the fiscal year 1986/87. Prep. for Research Management Division, Alberta Environment. RMD Report 87/51. 55 pp.

RESEARCH MANAGEMENT DIVISION

REVIEW

FOR THE FISCAL YEAR 1986/87

RESEARCH MANAGEMENT DIVISION

Alberta Environment

RMD Report 87/51

1987

TABLE OF CONTENTS

	Page
INTRODUCTION	1
Divisional Organization	1
ACID DEPOSITION RESEARCH PROGRAM	4
Projects	5
Publications	9
AIR QUALITY/CLIMATE RESEARCH PROGRAM	10
Projects	11
Publications	14
Acid Deposition and Air Quality/Climate Research Committees	15
BIOPHYSICAL RESOURCES RESEARCH PROGRAM	17
RECLAMATION RESEARCH SUB-PROGRAM	18
Projects	19
Publications	25
GEOSCIENCE RESEARCH SUB-PROGRAM	26
Projects	27
Publications	29
Biophysical Resources Committees	30
ENVIRONMENTAL CONTAMINANTS RESEARCH PROGRAM	31
Projects	33
Publications	36
Environmental Contaminants Research Committees	37
ENVIRONMENTAL EMERGENCIES AND RISK ASSESSMENT RESEARCH SUB-PROGRAM	38
ENVIRONMENTAL INFORMATION RESEARCH SUB-PROGRAM	39
Environmental Emergencies, Risk Assessment and Information Research Committees	40
WATER RESOURCES RESEARCH PROGRAM	41
Projects	42
Publications	46
Water Resources Research Committees	47
WATER TREATMENT AND WASTE MANAGEMENT RESEARCH PROGRAM	48
Projects	49
Publications	52
Water Treatment and Waste Management Research Committees	55

INTRODUCTION

The objectives of the Research Management Division (RMD) are:

1. To provide timely and authoritative scientific and technical information to other operational divisions within Alberta Environment;
2. To plan and co-ordinate the scientific environmental research planning requirements of the department; and
3. To publish research on environmental matters that are pertinent to departmental and provincial needs.

To realize these objectives, the Research Management Division aids in the co-ordination of all the department's environmental research and ensures that available research funds are spent on activities that respond to priority needs. To this end, RMD acts as a co-ordinator of research carried out on behalf of the department at the Alberta Environmental Centre in Vegreville. As well, divisional staff constantly interact with other line divisions of Alberta Environment to keep their programs current and of direct applicability to the department.

In its research management capacity, the Research Management Division actively manages or oversees a number of environmental research projects. As a rule, proposals for projects are solicited by RMD as needs are identified and terms of reference developed. However, unsolicited proposals may be submitted through other divisions of Alberta Environment or directly to RMD. All are reviewed in the light of departmental objectives and program requirements.

Divisional Organization

The Division combines diverse skills such as project management, budgeting and financial control, contracting, and publication editing, with comprehensive knowledge in many scientific areas pertinent to environmental research. The Division's expertise, which allows for a comprehensive approach to environmental problem solving, is drawn from such fields as hydrology, climatology, pedology, biology, meteorology, ecology, and sociology.

The organizational structure of RMD merges a functional management mode, compromising four scientific systems or working groups (air, human,

land, and water), into a matrix system with a number of well-defined scientific research programs. The prime advantage of this structure is its flexibility, allowing for an interdisciplinary approach to environmental research. For instance, the Division's work in the area of acid deposition includes research on the complex interface between the atmosphere and biosphere, that is, how atmospheric pollutants affect soils and vegetation.

During the 1986/87 fiscal year, the division's research programs were:

1. Acid Deposition;
2. Air Quality/Climate;
3. Biophysical Resources;
4. Environmental Contaminants;
5. Environmental Emergencies and Risk Assessment;
6. Environmental Information;
7. Water Resources; and
8. Water Treatment and Waste Management.

Each is defined by a comprehensive descriptive document that is updated regularly to keep its objectives current. Environmental concerns in Alberta are continually examined and incorporated into the Division's active programs. The final research program is scrutinized by an active Technical Advisory Committee made up of the Department's operational divisional heads. Through this mechanism, the research carried out addresses operational needs of the line divisions.

The Division has provided a 5-Year Research Plan which incorporates the above mentioned programs and program documents. With timely semi-annual reviews this Plan would ensure that the research program is able to keep up with changing needs and new information pertaining to environmental research. As necessary, new programs are developed while others may be terminated. Budget funds are allocated to each of the programs on the basis of priorities determined by Alberta Environment. With the severe budget reductions throughout the year, as much money as possible was channeled into contract research in support of the department.

The Alberta Oil Sands Environmental Program (AOSERP) has been an active part of environmental research in Alberta. As the focus of the program changed to encompass all energy related aspects of oil sands development, the

program moved away from the Fort McMurray location. At Fort McMurray, the program had a supporting office as well as operated the Mildred Lake Environmental Research Facility. These operations were closed in 1987 and the resouces freed were deployed to other research areas. In order to summarize the research carried out by AOSERP, a 10-Year Summary Report was produced which will be published in the coming fiscal year (1987/88).

A large portion of staff time was spent participating in the departmental, interdepartmental, and interagency committees that co-ordinate research programs. The division was represented on 48 committees, 9 being departmental committees, and the remainder interagency or interdepartmental committees such as the Reclamation Research Technical Advisory Committee (RRTAC) and the Federal/Provincial Long-Range Transport of Atmospheric Pollutants (LRTAP) committees. Involvement in these committees has enhanced the effectiveness of the division and its management capabilities, and has ensured that the professional staff have maintained an awareness of current environmental research activities in Alberta and elsewhere.

To further the Division's expertise, staff also attended and presented papers at scientific conferences and meetings in a variety of locations in Canada and the United States. In addition, they sponsored workshops and seminars on various research topics.

ACID DEPOSITION RESEARCH PROGRAM

The Acid Deposition Research Program (ADRP) is designed to plan and implement research, specific to Alberta, on the environmental impact and the medium- to long-range transport of acid-forming emissions. The program addresses the following objectives:

1. To characterize sensitive environmental ecosystems and develop methodologies to identify and/or predict measurable short-, medium-, and long-term effects of acidic or acidifying substances on Alberta ecosystems;
2. To determine the characteristics and quantities of both long-range emissions and those generated locally, and to examine their effects on the environment;
3. To develop a basis and approach for preventive strategies and environmental protection with respect to acid deposition; and
4. To coordinate departmental research on acid deposition with other private and public agencies in Alberta and the rest of western Canada.

Research is conducted in three major program areas: (1) an acid deposition effects research program developed for the oil sands region of northeastern Alberta; (2) the Western and Northern Canada Long-Range Transport of Air Pollutants (W&NC-LRTAP); and (3) the Alberta Government/Industry Acid Deposition Research Program (AG/IADRP). The research undertaken in these programs will provide information that will help Albertans understand the potential effects of acid-forming emissions on soil, vegetation, aquatic systems, and human health. The results will be used to evaluate and refine Alberta's air quality standards; to develop regulatory and control strategies to prevent environmental damage due to acid deposition; and to help plan provincial industrial development.

PROJECTS

Application of MESOPUFF2 (Transport/Deposition Mesoscale Model) in the Oil Sands Region of Northern Alberta

Medium- and long-range (mesoscale) models for determining deposition patterns of acid-forming substances are available. As western Canada is characterized by lower pollutant levels and more single point emission sources, the time and space resolution of long-range deposition models may be inadequate for estimating deposition. The potential acidification of environmental receptors in western Canada is probably more a consequence of medium-range or mesoscale transport and deposition of pollutants from local sources.

The Western and Northern Canada Long-Range Transport of Air Pollutants Technical Committee commissioned a Mesoscale Modelling Task Group to evaluate and recommend mesoscale transport/deposition models for implementation in western Canada. Of the models selected, it was recommended that the Lagrangian mesoscale deposition model, MESOPUFF2, be acquired by Alberta Environment and implemented in the oil sands region.

The objective of this study was to determine the feasibility of applying MESOPUFF2, the prediction module of the LERTAD (Lagrangian Estimates for Regional Transport and Acidic Deposition) modelling system, to northern Alberta and Saskatchewan. The model was to be implemented and its applicability for determining the deposition and concentration of atmospheric pollutants assessed.

Contractor: Concord Scientific Corporation
Funding: $20 000.00

Design and Development of an Aerometric Program in Support of Terrestrial and Aquatic Effects Research in the Athabasca Oil Sands Region

Alberta Environment has developed an acid deposition effects research program in response to a departmental directive to research the effects of acid deposition on forested and aquatic ecosystems in the oil sands area. The biophysical and aquatic effects research are designed to address the question: Is there measurable short- or long-term environmental damage due to

acidification? If ecosystem damage is occurring, the hypotnesis is that the pollutant loading and some corresponding quantitative measurement of damage will vary significantly among the low, medium, and nigh plume impingement zones. The primary objective of the integrated study is to develop ecological monitoring tools for both the terrestrial and aquatic ecosystems which can be used to detect environmental effects of acid-forming emissions. One integral component of the program is to characterize and quantify the total pollutant loading and climate at each receptor site. Sulphur dioxide is generally considered the most phytotoxic of the acidic or acidifying substances. However, tne environmental effects of SO_2 must be considered in the context of tne total pollutant burden. For forest ecosystems, the effect of climate and pests/disease on the 'health' of the forest must also be accounted for.

Tne objective of tnis study was to develop and design a detailed and comprenensive monitoring protocol to:

1. Characterize and quantify tne total pollutant loading and climate for terrestrial and aquatic receptor sites; and
2. Discriminate between the total pollutant loadings at sites selected in tne low, medium, and nign plume impingement zones and control area.

Contractor: Concord Scientific Corporation
Funding: $74 780.00

Evaluation of Alternative Methods for Measuring Dry Deposition and Recommendations for Establishing a Regional Scale Dry Deposition Monitoring Network in Alberta

Tne total deposition of acid-forming substances and the subsequent environmental effects are dependent on two components: wet and dry deposition. In Alberta, dry deposition is considered to be as important as wet deposition. However, tne amount of dry deposition relative to the total deposition is unknown. The establishment of a regionally representative as opposed to a source-oriented dry deposition monitoring network is required to provide estimates of the contribution of dry deposition to the total depositon. Although a wide range of metnods for monitoring dry deposition are

available, they have not been extensively applied in routine monitoring networks. This is due, in part, to several factors: inaccuracies of the methods; high cost and complexity of some methods; the limited applicability in terms of measurable pollutants; the temporal resolution needed; and uncertainties about how to obtain the necessary measurements. The objectives of this study were to:

1. Review and evaluate alternate methods, such as surrogate surfaces for measuring dry deposition of sulphur and nitrogen oxides;
2. Evaluate methods for determining deposition fluxes to vegetation canopies from atmospheric concentration data and supporting meteorological and biophysical data; and
3. Recommend the most cost-effective, scientifically acceptable methods for deployment of a province wide dry deposition monitoring network.

Contractor: Concord Scientific Corporation

Funding: $49 960.00

Government/Industry Acid Deposition Research Program - Biophysical Research

The Alberta Government/Industry Acid Deposition Research Program is an $8 million project of Alberta Environment, the petroleum industry, the Energy Resources Conservation Board, and the electrical utilities, designed to assess the effects of acid-forming gases on the environment and human health. The biophysical research concentrates primarily on agricultural areas in the southern part of the province. The first critical phase of the biophysical program involves:

1. A characterization and quantification of local and regional air quality;
2. An assessment of the potential impact of air quality on the environment;
3. An inventory of sulphur oxide and nitrogen oxide emissions in Alberta; and
4. A world literature review on the effects of acid deposition on vegetation, soils, and surface and groundwaters.

Contractor: Kananaskis Centre for Environmental Research (KCER)

Funding: $500 000.00 Alberta Environment (Research Management Division)
$500 000.00 Petroleum Industry, Electrical Utilities, and the Energy Resources Conservation Board

2nd Symposium/Workshop on Acid-Forming Emissions in Alberta and Their Ecological Effects, 1986 May 12-15

Over the past 10 years, a series of symposia/workshops have been held to address the question of the environmental effects of air pollution in Alberta. The first three of these symposia/workshops were referred to as the Alberta Sulphur Gas Research workshops; and were held in 1973, 1975, and 1977. The most recent one, held in Edmonton in 1982, was called the First Symposium/Workshop on Acid-Forming Emissions in Alberta and Their Ecological Effects. As a result of increasing public and scientific concerns on the issue of acid deposition, a 2nd Symposium/Workshop on Acid-Forming Emissions in Alberta and Their Ecological effects was held 1986 May 12-15. The purpose of the symposium/workshop was to:

1. Provide perspective and information on the issue of acid deposition;
2. Improve the exchange of information on environmental research, monitoring, control technologies, and regulation policy;
3. Identify and provide the rationale for future research needs; and
4. Involve the public.

The symposium/workshop was jointly sponsored by Alberta Environment, the Canadian Petroleum Association, the Energy Resources Conservation Board, and the Kananaskis Centre for Environmental Research.

Contractor: Kananaskis Centre for Environmental Research, University of Calgary

Funding: $18 000.00 Alberta Environment
$10 000.00 Canadian Petroleum Association
$ 5 000.00 Energy Resources Conservation Board
$ 5 000.00 Kananaskis Centre for Environmental Research, University of Calgary

PUBLICATIONS

Addison, P.A., S.J. L'Hirondelle, D.G. Maynard, S.S. Malhotra, and A.A. Khan. 1986. Effects of oil sands processing emissions on the boreal forest. Information Report NOR-X-284. 31 pp.

Baker, B.L. 1985. Attenuation of pollutants by Alberta soils. Prep. for Research Management Division, Alberta Environment by Kananaskis Centre for Environmental Research, University of Calgary. RMD Report L-89. 26 pp.

Davis, C.S., P. Fellin, D. Stevens, S. Todd, and K. Heidorn. 1985. Evaluation, analysis, and assessment of snowpack and precipitation data from a monitoring network in the AOSERP study area. Prep. for Research Management Division, Alberta Environment by Concord Scientific Corporation. RMD Report 86/36. 341 pp.

Other Publications

Sandhu, H.S. and L. Blower. 1986. Acid-forming emissions in Alberta, Canada. Environmental Management 10(5):689-695.

Sims, H.P., G.A. Singleton, and H.S. Sandhu. 1986. An overview of Alberta Environment's acid deposition program. Paper presented at the 2nd Annual Seminar on Acid-Forming Emissions in Alberta, 1986 May 12-15.

AIR QUALITY/CLIMATE RESEARCH PROGRAM

Pollutant emissions and their secondary or tertiary reaction products are important contributors to the degradation of air quality. In recent public surveys, air quality was identified as a leading environmental concern in Alberta; the issue ranked fourth in 1981 and first in 1982 and 1983. The objectives of the air quality sub-program are to characterize and quantify atmospheric pollutants and delineate their effects on air quality, the environment, and climate. Research priorities, at this time, are focussed on flaring, urban air quality, and fugitive and uncontrolled emissions. Research results will be used to determine the best possible management strategies and regulatory controls to prevent or mitigate degradation of air quality.

The impacts of climate change and increased climate variability have become more widely recognized. The potential ramifications of such aberrations for Alberta are not fully known. The climate sub-program will address the impacts of climate variability on the management and development of Alberta's economic and human resources. Program direction is determined by an interagency/interdepartmental committee, chaired by the Research Management Division, with representation from the Alberta government departments of Environment; Agriculture; Forestry Lands and Wildlife; Environment Canada; Alberta Research Council; Canadian Petroleum Association; universities; and the Alberta Climatological Association. Recommendations from the sub-program will be used to develop and implement strategic plans to minimize the potentially adverse impacts and maximize the positive impacts of climate variability. The sub-program will complement the Canadian Climate Program as recommended by the Canadian Council of Resource and Environment Ministers.

PROJECTS

Feasibility of a Climate Service Centre in Alberta

Climate data users and collectors recently identified the need to research the feasibility of establishing a climate service centre in Alberta. This need arose in part from a recommendation in the report "Assessment of Collection and Handling of Climate Data by Alberta Government Agencies (RMD Report 82/12). The concept of climate service centres is also under consideration by the National Climate Advisory Committee (NCAC). Planning is underway to establish a Maritime Climate Service Centre in Newfoundland. The NCAC and the Canadian Climate Program Planning Board support the initiative to investigate the feasibility of a similar climate service centre in Alberta.

A climate service centre is more than a data depository. The centre could maintain a provincial data archive; produce derived data summaries such as agroclimate statistics or water balance calculations; support ongoing research projects specifically geared to climate impact and applications; and prepare climate data publications for distribution to the public and interested users. The objectives of this study were to:

1. Review available information on existing and proposed climate service centres in Canada and the United States;
2. Evaluate the need for a climate service centre in Alberta;
3. Assess the feasibility of a climate service centre operating in Alberta;
4. Detail the advantages and disadvantages of a climate service centre;
5. Outline the resources required to operate a climate service centre; and
6. Recommend whether a climate service centre is needed and the type required to address Alberta's climate needs.

Contractor: KelResearch Corporation and W_X Research House Inc.

Funding: $20 000.00

Stack Aerodynamic Downwash

Low flow rates in industrial stacks emitting air pollutants leads to a situation where the plume is pulled down behind the stack. This reduced plume rise causes higher ground level concentrations of pollutants. The sour gas industry is currently experiencing low flows either because of low production rates or reduced incinerator temperatures for fuel gas savings. There is a paucity of information and ongoing research on stack aerodynamic downwash. Preliminary investigations have demonstrated the need for more intensive field observations. The objectives of this project were to study, at selected gas plants, the stack downwash phenomena of incinerator stack plumes by:

1. Obtaining good observations of time average and instantaneous plume behaviour under a variety of environmental and stack downwash conditions;
2. Investigating the conditions for the onset of downwash; and
3. Investigating the behaviour of a buoyant plume under stack downwash conditions for various stack designs.

The project was cancelled due to prevailing warm temperatures which precluded the successful execution of the field work.

Contractor: Monenco Consultants Limited

Funding: $30 000.00 (only $9213.68 was actually committed to the project)

Study of Flare Stack Operations

The efficiency of flaring in the disposal of reduced and oxidized sulphur compounds in the oil, natural gas, petroleum, and chemical industries has been a concern for several years. Odour, smoke, air quality, and health problems in the vicinity of gas plants and petrochemical industries have been attributed to flaring operations. The real or perceived risks associated with these activities has given rise to environmental questions which must be adequately addressed. To more clearly define the health and environmental problems associated with flaring, the primary objectives of this study were to investigate a representative number of emergency and continuous flaring operations by: (1) undertaking a survey and assessment of current flaring practices used in oil and gas production in Alberta including criteria used in

the design and operation of flaring systems and the operational problems which may result in inefficient combustion; and (2) determining equipment reliability and effectiveness. This project will complement a concurrent study undertaken by Environment Canada which will assess current flaring technology.

Contractor: TITAN Projects Ltd.

Funding: $57 500.00 Alberta Environment
$17 500.00 Environment Canada

PUBLICATIONS

Cruden, D.M. 1986. Monitoring the south peak of Turtle Mountain, 1980 to 1985. Prep. for Research Management Division, Alberta Environment by Department of Civil Engineering, University of Alberta. RMD Report 86/37. 70 pp.

Jandali, T. and B. Hrebenyk. 1985. Urban air quality research needs in Alberta: A literature review and synthesis of available information. Prep. for Research Management Division, Alberta Environment by ESL Environmental Sciences Limited. RMD Report 85/33. 188 pp.

Peake, E., M.A. MacLean, and P.F. Lester. 1985. Nitric acid, peroxyacetyl nitrate (PAN), and particulate nitrate in the atmosphere of the City of Edmonton. Prep. for Research Management Division, Alberta Environment by Kananaskis Centre for Environmental Research, University of Calgary. RND Report 86/35. 304 pp.

Other Publications

Angle, R.P. and H.S. Sandhu. 1986. Rural ozone concentrations in Alberta, Canada. Atmospheric Environment 20(6):1221-1228.

ACID DEPOSITION AND AIR QUALITY/CLIMATE COMMITTEES

Departmental

Acid Deposition Program Planning Committee

Air Quality/Climate Program Planning Committee

Departmental Committee on Acid Deposition (DCAD)

Interagency/Interdepartmental

Alberta Climate Advisory Committee (Alberta Environment)

Alberta Climatological Association

Alberta Environmental Centre Technical Advisory Committee (AEC/TAC)

Alberta Environmental Research Trust - Grants Advisory Committee (GAC)

Alberta Government/Industry Acid Deposition Research Program (AGIADRP), Executive Committee

Alberta Government/Industry Acid Deposition Research Program (AGIADRP), Members Committee

Associate Committee on Scientific Criteria for Environmental Quality (National Research Council)

Atmospheric Sciences Program Subcommittee (Alberta Research Council)

Canadian Climate Program Planning Board (Environment Canada)

CCREM Ad Hoc Working Group on Monitoring Airborne Substances

Federal/Provincial Long-Range Transport of Atmospheric Pollutants (LRTAP), Acid Rain Steering Committee (Environment Canada)

Federal/Provincial Long-Range Transport of Atmospheric Pollutants (LRTAP), Acid Rain Research and Monitoring Coordinating Committee (RMCC), Atmospheric Sciences Group (Environment Canada)

Government/Industry Consultative Committee on Flaring

Olympic Secretariat Climate Advisory Committee (Alberta Recreation and Parks)

Second Symposium/Workshop on Acid-Forming Emissions in Alberta and Their Ecological Effects Steering Committee (Alberta Environment, University of Calgary, Energy Resources Conservation Board, Canadian Petroleum Association)

Sour Gas Flaring Committee

Symposium/Workshop on the Impacts of Climate Variability and Change on the Canadian Prairies Steering Committee (Alberta Environment, Alberta Research Council, Atmospheric Environment Service, and the Alberta Climatological Association)

Western and Northern Canada Long-Range Transport of Air Pollutants (W&NC-LRTAP), Tecnnical Committee (Britisn Columbia, Alberta, Saskatchewan, Manitoba, Northwest Territories, and Canada)

BIOPHYSICAL RESOURCES RESEARCH PROGRAM

The Biophysical Resources Research Program was established in 1986 to coordinate the research and technology transfer activities of four programs.

The Reclamation Sub-program is concerned with identifying efficient and effective methods of reclaiming surface disturbances in Alberta. Research is funded by the Research Management Division and by the interdepartmental Reclamation Research Technical Advisory Committee using Heritage Savings Trust Fund monies.

The Geosciences Sub-program coordinates research on natural resource development and natural hazards such as earthquakes and landslides. Research is funded by the Research Management Division.

The Biotechnology Sub-program was initiated in December 1986 with the establishment of the Alberta Biotechnology Committee, chaired by the Research Management Division. The role of this interdepartmental committee is to coordinate provincial activities regarding regulation of the rapidly developing Alberta biotechnology industry. The committee also interfaces with the federal government to ensure that federal-provincial coordination occurs. There are no active research projects in the sub-program.

The Resource Inventory Sub-program is still in a developmental stage. Environmentally safe development of Alberta's resources requires detailed, up-to-date information on soils, geology, hydrology, and vegetation. Development of new technologies such as Geographic Information Systems and Computer Assisted Mapping, and refinements in older technologies such as Remote Sensing are rapidly improving our capabilities to gather and display such information. The preliminary goal of the Resource Inventory Sub-program is to ensure dissemination of information on resource inventory techniques to potential users in the department. There are no active research projects in the sub-program.

RECLAMATION RESEARCH SUB-PROGRAM

In Alberta, land disturbed by large-scale surface mining operations must be returned to equal or better capability. The Reclamation Research Sub-program is designed to identify methods that will make the reclamation process more efficient and effective. Research is centred on:

1. Determining methods of rebuilding productive soils (physically, chemically, and biologically);
2. Identifying changes in the quantity and quality of surface water and groundwater following disturbance and reclamation;
3. Developing suitable plant species for reclamation;
4. Controlling erosion; and
5. Improving materials-handling operations.

Recommendations arising from the program will be used to refine the government's Development and Reclamation Guidelines.

Reclamation research within Alberta Environment is coordinated by the Biophysical Resources Program Planning Committee chaired by the Research Management Division. The Committee developed a prioritized list of research needs for the 1987/88 fiscal year.

Research Management Division also assumes managerial and administrative responsibilities for reclamation research in association with the interdepartmental Reclamation Research Technical Advisory Committee (RRTAC).

RRTAC members are from the Alberta government departments of Agriculture, Energy, Forestry, Lands and Wildlife, and Environment, and the Alberta Research Council. The direction of projects and sub-programs in three biophysical regions (Plains, Mountains and Footnills, and Northeast Alberta) is coordinated by government/industry committees. In 1986/87, RRTAC committed approximately $1.2 million to reclamation research through the Heritage Savings Trust Fund (HSTF).

PROJECTS

Assessment of Reclamation Potential and Hydrological Impact of Large-Scale Surface Mining in Plains Areas of Alberta

The main objective of this project is to develop a thorough understanding of the materials present and the hydrologic and geologic processes acting within a particular landscape. The results of various surface landform and materials placement designs will then be assessed with reference to potential land use options following mining.

Contractor: Dr. S.R. Moran, Natural Resources Division, Alberta Research Council

Funding: $797 853.00 ($666 000.00 Alberta Heritage Savings Trust Fund; $131 583.00 (Alberta Research Council)

Battle River Soil Reconstruction Project

Tne objectives of this study are:

1. To determine the required deptn of soil placement over sodic mine spoil to ensure that mined land, particularly in the Battle River Coal Field, meets reclamation objectives;
2. To develop methods of sustaining re-established capability, with emphasis on controlling salt movement from mine spoil into the reconstructed root zone; and
3. To develop treatments that will minimize soil quantities needed to restore the original capability of the land.

Contractor: Mr. L.A. Leskiw, Can-Ag Enterprises

Funding: $145 000.00 (Alberta Heritage Savings Trust Fund)

Biological Dewatering of Oilsand Sludges

In Phase I of tnis project, experiments were conducted to quantify the rates of water removal from tailings and sludge by plant evapotranspiration and to correlate the residual water content with shear strength.

Contractor: Dr. E. Dale Allen

Funding: $109 500.00 ($33 100.00 Alberta Heritage Savings Trust Fund; $22 600.00 Alberta Environmental Centre; $53 800.00 Syncrude Canada Ltd.)

Highvale Soil Reconstruction Project

The objectives of this study are:

1. To determine the required depth of soil replacement over sodic mine spoil to ensure that mined land, particularly in the Highvale Mine Permit Area, meets reclamation objectives;
2. To assess the sustainability of re-established capability with empnasis on monitoring salt movement from mine spoil into the reconstructed root zone; and
3. To examine the effects of slope aspect and slope steepness on water movement, salt movement, and productivity.

Contractor: Mr. L.A. Panek, Monenco Consultants Ltd.

Funding: $140 000.00 (Alberta Heritage Savings Trust Fund)

Mountains/Foothills Reclamation Research Program: Assessing Design Flows and Sediment Discharge on the Eastern Slopes

This study is divided into two segments. The first, a literature investigation, will evaluate and provide a methodology to assess precipitation, flood flows, and sediment discharge in mountain/foothills regions of Alberta. The parameters will be assessed with respect to their implications for settling impoundment design, and culvert and drainage ditch sizing in coal mining developments. The design of a field program to measure the above parameters is also included.

The second part of the program will monitor these parameters at sites in the mining area responsible for producing most of the sediment loads: a haulroad, plantsite and a reclaimed pit site.

Contractor: Mr. Gary (R.E.) Beckstead, P.Eng., Hydrocon Engineering Ltd.

Funding: $14 000.00 (part one) ($7000.00 Alberta Heritage Savings Trust Fund; $7000.00 The Coal Association of Canada)

Mountains/Foothills Reclamation Research Program: Growth Performance of Commercial Timber Species

The purpose of this project is to define reasonable expectations of growth performance rates, as well as procedures that will be used to evaluate the successful reforestation of reclaimed lands within the Eastern Slopes.

Contractor: W.R. Dempster and Associates Ltd.

Funding: $47 370.00 ($23 685.00 Alberta Heritage Savings Trust Fund; $23 685.00 The Coal Association of Canada)

Mountains/Foothills Reclamation Research Program: Settling Pond Research Project - Phase II

The purpose of this project is to establish the scientific basis for the existing water quality and quantity legislation for mines in the Eastern Slopes of Alberta. The project will document the source and basis of various parameters for water quality and design flows with specific reference to the Alberta Eastslopes conditions.

Contractor: Mr. Brian Bietz, Beak Associates Consulting Ltd.

Funding: $12 000.00 ($6000.00 Alberta Heritage Savings Trust Fund; $6000.00 The Coal Association of Canada)

Mountains/Foothills Reclamation Research Program: Wildlife Habitat Certification Handbook

This study focusses on the development of criteria for the certification of wildlife habitat and the development of a reclamation handbook outlining procedures for certification.

Contractor: Delta Environmental Management Group Ltd.

Funding: $21 000.00 ($10 500.00 Alberta Heritage Savings Trust Fund; $10 500.00 The Coal Association of Canada)

Oil and Gas Reclamation Research Program: Drilling Mud Disposal

The purpose of this project is to provide a scientific basis for development of guidelines for drilling mud solids disposal that optimizes environmental safety and cost effectiveness by carrying out problem analysis, and preliminary research to identify environmental limitations of available disposal technology.

Contractor: Mr. T. Macyk, Natural Resources Division, Alberta Research Council
Funding: $76 660.00 ($49 715.00 Alberta Heritage Savings Trust Fund; $26 945.00 Alberta Research Council)

Oil and Gas Reclamation Research Program: Soil Compaction

This project has three objectives:

1. To identify a measure of soil compaction useful for field evaluations on reclaimed oil and gas leases in Alberta;
2. To develop "trafficability" guidelines to prevent soil compaction on oil and gas leases in Alberta; and
3. To identify the most effective and cost-efficient method of permanently alleviating soil compaction on oil and gas leases in Alberta.

Contractor: Dr. J. Campbell
Funding: $45 000.00 ($30 000.00 Alberta Heritage Savings Trust Fund; $15 000.00 Alberta Environmental Centre)

Oil Sands Tailings Soil Reconstruction Project

The objective of this project is to identify methods of constructing soils from tailings sand, peat, and clay materials that will:

1. Support desired initial vegetation cover; and
2. Evolve over time and in response to the forces of pedogenesis, in the oil sands region, into a soil capable of supporting a maintenance-free forest at the desired level of productivity.

Contractor: Mr. H.E. Martens, Hardy BBT Limited
Funding: $84 000.00 ($42 000.00 Alberta Heritage Savings Trust Fund; $42 000.00 Syncrude and Suncor)

1988 International Conference on Drilling Wastes

The Canada Oil and Gas Lands Administration is organizing an international conference on drilling fluids, to be held in Calgary in 1988. Environmentally safe methods of drilling fluid disposal are a pressing need for Alberta Environment, and Alberta Forestry, Lands and Wildlife. This

project will provide partial funding for the organization of a conference that will attract world class speakers to address tnis problem.

Contractor: Info-Tech (Calgary)

Funding: $2500.00 (Research Management Division)

Reclamation of Sulphur-Contaminated Soils

The objective of this project is to determine the amount of elemental sulphur that can be left in soil and be amended with calcium carbonate without significant adverse impact on soil or vegetation. This is a significant problem since the market demand for elemental sulphur in Alberta is such that many gas plants will soon be faced with the reclamation of large areas of sulphur-contaminated soils.

Funding: $35 000.00 for projects listed below (Research Management Division) Gulf Canada Corporation and Canterra Energy Limited contributed an additional $30 000.00 to the project

Reclamation of Sulphur-Contaminated Soils: Fence Construction

Contractor: Westerra Environmental Consulting Ltd.

Funding: $8005.00

Reclamation of Sulphur-Contaminated Soils: Literature Review

Contractor: Ms. S. Leggett

Funding: $6330.00

Reclamation of Sulphur-Contaminated Soils: Laboratory Analysis

Contractor: Ms. C. Selby

Funding: $4000.00

Reclamation of Sulphur-Contaminated Soils: Microbiological Oxidation Study

Contractor: Mr. H. Komadowski

Funding: $15 000.00

Reclamation of Sulphur-Contaminated Soils: Data Analysis

Contractor: Mr. T. Entz

Funding: $1665.00

Reinstatement of Mycorrhizal Potential in Reconstructed Soils

Mycorrhizal fungi are very important to the nutrition of trees. This project will determine the survival and inoculum potential of mycorrhizal fungi in undisturbed and reconstructed soil to be used in oil sands tailings reclamation. Also, fungal species will be selected for use in jack pine inoculation programs and mycorrhizal development will be monitored in field trials.

Contractor: Dr. D. Parkinson, Kananaskis Centre for Environmental Research, University of Calgary

Funding: $33 000.00 (Alberta Heritage Savings Trust Fund)

PUBLICATIONS

Macyk, T. 1986. Characterization and variability of soils reconstructed after surface mining in Central Alberta. Alberta Land Conservation and Reclamation Council. Report RRTAC 86-2. 146 pp.

Maslowski-Schutze, A. 1986. Chemical and mineralogical properties of overburden: Plains hydrology and reclamation project. Alberta Land Conservation and Reclamation Council. Report RRTAC 86-7. 25 pp.

Monenco Consultants Ltd. 1986. Critical analysis of settling pond design and alternative technologies. The Coal Association of Canada and Alberta Land Conservation and Reclamation Council Report RRTAC 86-1. 372 pp.

Trudell, M.R. and S.R. Moran. 1986. Generalized procedures for assessing post-mining groundwater supply potential in the plains of Alberta. Alberta Land Conservation and Reclamation Council. Report RRTAC 86-3. 30 pp.

Ziemkiewicz, P.F., ed. 1986. Reclamation Research Annual Report 1985. Alberta Land Conservation and Reclamation Council. Report RRTAC 86-8. 54 pp.

GEOSCIENCE RESEARCH SUB-PROGRAM

The Geoscience Research Sub-program was developed to coordinate research in the areas of natural resource development and natural hazards such as earthquakes and landslides. Research in geology, geophysics, geotechnical engineering, and soil sciences is covered by this program.

This program is intended to provide scientific information for evaluating and reviewing Alberta Environment's standards, and will assist in establishing long-term policies to ensure that Alberta's natural resources are used in an efficient and responsible manner.

PROJECTS

A Landslide Overview Map of Alberta

The objective is to create an overlay on a bedrock geology map of Alberta showing landslide incidence and susceptibility of the bedrock to instability. Alberta's major settlements lie along the sides of the valleys of its major rivers. These valley walls have proved to be subject to movements resulting in damage to property and the withdrawal of otherwise valuable serviced land from development. The final document will be useful to planners and developers as a general guide to problem areas; it will be useful in studies of transportation routes and in assessing water supply and development schemes.

Contractor: D.M. Cruden and S. Thomson, University of Alberta

Funding: $10 000.00 (Research Management Division)

Deformation Surveys Research

The work involves reviewing existing standards and specifications for conventional, photogrammetric and satellite surveys. This would only be a starting point, however, since all such existing standards and specifications have been prepared under the assumption that coordinates of points are the essential end results. In deformation surveys, by contrast, movements of points are the essential end results, and coordinates of points have to be known only approximately.

Once existing standards and specifications have been reviewed, parts of these standards and specifications which might also be appropriate for deformation surveys will be identified. Special features of standards and specifications for deformation surveys will then be investigated.

Contractor: Dr. E. Krakiwsky, University of Calgary

Funding: $23 000.00 (Grant - Research Management Division)

Microseismicity of the Strachan Gas Field

The microseismic activity observed near Rocky Mountain House since 1976 is clearly associated with hydrocarbon recovery techniques in the Strachan B pool. Aside from a brief local survey by a seismologist from

Earth Physics Branch, Ottawa, no careful local study has been made of this phenomenon. Magnitude 4.2 earthquakes have been felt in the area and a possibility exists that a 5.5 will occur. Such an event would probably damage both the Strachan and the Ram River gas plants and could cause damage or injury in Rocky Mountain House. This project is intended to install four University of Alberta event detecting seismic recorders near well heads and pollution monitoring trailers in the area. The data from these recorders should give a clear picture of the seismic swarm that will clarify the abundant data the University has at the Leduc seismic station. The result of the project will be a working seismic network complete with data processing facilities and, nopefully, some ideas on the causes of the swarm.

Contractor: Dr. E. Nyland, University of Alberta

Funding: $13 500.00 (Research Management Division)

Remote EDM Monitoring of Fractures on Turtle Mountain - Preparation of the Final Report

In the past five years, Dr. E.G. Anderson of the Division of Survey Engineering, University of Calgary, has implemented a program of remote electronic distance measuring of cracks near the crest of Turtle Mountain. The results of this program are presently under three separate covers. As Alberta Environment considers this research to be a significant advancement in the field of survey engineering, the purpose of this contract is to have a report of the entire program condensed under a single cover for wide-scale distribution.

Contractor: Dr. E.G. Anderson, University of Alberta

Funding: $1500.00 (Research Management Division)

PUBLICATIONS

Cruden, D.M. 1986. Monitoring the south peak of Turtle Mountain, 1980 to 1985. Prep. for Alberta Environment, Research Management Division and Earth Sciences Division by Department of Civil Engineering, University of Alberta. RMD Report 86/37. 70 pp.

BIOPHYSICAL RESOURCES COMMITTEES

Departmental

Biophysical Resources Program Planning Committee

Acid Deposition Program Planning Committee

Interagency/Interdepartmental

Alberta Biotechnology Committee

Mountains and Foothills Reclamation Research Program Steering Committee

Mountains and Foothills Reclamation Research Program Revegetation Subcommittee

Oil and Gas Reclamation Research Program Steering Commitee

Oil Sands Reclamation Research Program Steering Committee

Oil Sands Reclamation Research Program Technical Committee

Plains Coal Reclamation Research Program Steering Committee

Plains Coal Reclamation Research Program Soil/Crop Subcommittee

Reclamation Research Technical Advisory Committee

Soil pH Technical Committee

Turtle Mountain Study Team (Alberta Environment, Alberta Forestry, Lands and Wildlife, Alberta Disaster Services, Alberta Culture)

ENVIRONMENTAL CONTAMINANTS RESEARCH PROGRAM

Contaminants impact the environment through industrial discharges, spills, spraying programs and natural releases. These released substances pose a substantial present or potential hazard to human health or living organisms because such wastes are lethal, non-degradable, and/or persistent in nature. These products also may be biologically magnified, or may otherwise cause or tend to cause detrimental cumulative effects.

The main objective of the contaminant program is to plan, design, and implement research for the operating divisions to develop standards and guidelines criteria, contaminants control, environmental monitoring, and project planning. The specific program objectives are:

1. To develop a mechanism to set priorities and to identify contaminants of concern within the province of Alberta;
2. To develop routine monitoring guidelines in order to determine short- and/or long-term trends in environmental quality;
3. To characterize sensitive environmental components and to develop mechanisms to identify and/or predict environmental deterioration caused by contaminants in Alberta;
4. To develop a mechanism whereby information relative to the fate and effect of contaminants can be generated and from which mitigative actions and decisions can be directed;
5. To develop a scientific basis and approach for preventative strategies and environmental protection taking into account socio-economic factors; and
6. To provide support for the coordination and integration of research and monitoring activities with other departments, governments, industry, and agencies.

Major issues surrounding environmental contaminants are of concern to both public and scientific communities. The public is concerned about the release of contaminants into the ecosystem from various industrial practices and landfill activities. They also question the effectiveness and rationale of current standards. Issues on human health and environmental consequences are subject to much debate and skepticism. Present analytical techniques are identifying compounds at lower and lower concentrations while our under-

standing of the effects of these compounds is generally not known or poorly understood. The scientific community concerns are aimed at developing standards that would be acceptable and safe to the public and encourage the wise use of our renewable resources. The development of new methodology and equipment to upgrade analytical state-of-the-art technology in contaminant research is also a priority.

Federal-Provincial Decommissioning Workshop Recommendations

Industrial site decommissioning is a major contaminant issue in Alberta. It is estimated that 20% of the existing Canadian industrial capacity will be shut down by 1990. In order to assist with this extensive decommissioning, a clean-up research support program is planned to provide clean-up criteria (how clean is clean); confirmatory chemical analyses; long-term monitoring methodologies; and preventive measure strategies. New legislations are being prepared and guidelines are being developed. In order to address these issues and provide the relevant scientific information for sound decision making, a well developed plan of action is required.

Contractor: Monenco Consultants Ltd.
Funding: $5 000.00

PROJECTS

Fish Tainting Potential of Oil Sands Wastewaters

This project was designed to determine the potential for selected oil sands wastewaters to taint rainbow trout. Tainting was assessed utilizing a sensory evaluation panel of 10 prescreened and trained individuals who measured tainting on the basis of odour. Extracted bile from exposed fish was also analyzed by high pressure liquid chromatography (HPLC) with fluorescence detection. Results from this highly sensitive technique were comparable to that obtained from sensory evaluation in determining the relative sensitivity for assessing fish exposed to oil sands contaminants. Analyses of tissue from exposed fish was also attempted during this study.

Contractor: Dr. Steve Hrudey (Dept. of Civil Engineering, University of Alberta)

Funding: $13 000.00

The Persistence and Movement of Contaminants from Heavy Oil Recovery

Heavy oil recovery processes in Alberta generate potentially toxic or biologically active organic compounds. How hazardous these chemicals would be to the environment, should they accidentally be released, cannot be determined until their fates (i.e., movement, accumulation, and persistence) are better understood.

The environmental behaviour of a contaminant can be estimated using a mathematical model. The model upon which this study is based involves the concept of fugacity, a thermodynamic process which outlines the movement of substance between different phases. This concept was used to determine the approximate equilibrium and non-equilibrium distribution for a range of potential organic contaminants in a variety of model environments. It also allowed for the examination of behavioural changes in the contaminant with alterations in the proportion of the phases within the environmental system, and with variations in input, advection, and transformation rates. The study provided insight into transfer mechanisms, under non-equilibrium conditions, such as the examination of the diffusive transfer of dissolved organic substances into fish to reveal the probable source of tainting. A comparison

of transformation and other removal mechanisms were documented to allow selection for persistent organic compounds.

Contractor: Mr. E. Peake and Dr. N. Okazawa (Kananaskis Centre for Environmental Research, University of Calgary)

Funding: $45 000.00

A Preliminary Investigation into the Use of Spikerush (Eleocharis acicularis for Aquatic Plant Management in Irrigation Canals in Alberta)

The prolific growth of aquatic plants in irrigation canals in Alberta has caused serious problems by reducing the flow of water, plugging of sprinkler systems, and in some cases, flooding of farmlands. As a result, tnese weeds are considered to pose a threat to the overall efficiency of irrigation, therefore, control options should be explored.

The use of spikerush, Eleocharis spp. as a replacement species to displace problem plants is being investigated. Slender spikerush, Eleocharis acicularis has evidently invaded irrigation canals at several locations. These plants are flooded from May to September annually by neutral to slightly alkaline, nutrient poor irrigation water from the Bow River. Field test plots have been established to determine the natural growth rates of spikerush. Sod transplants have been placed in canals to assess how well spikerush would compete with established stands of pondweed, Potamogeton spp. Preliminary investigations have shown successful vegetative reproduction of spikerush from sod, sprigs, and rhizomes. Treatments to ennance seed germination including stratification and scarification have indicated that the tough seed coat of spikerush limits germination.

Contractor: Dave Reid (Hardy BBT Ltd.)

Funding: $16 858.00

Threshold Values for Selected Chemicals Capable of Taste and Odour Tainting in Fish of the Athabasca River

Chemical compounds associated with oil sands mining and upgrading have been implicated in fish tainting problems in the Athabasca River north of Fort McMurray. Very little quantitative information, however, exists on the minimum levels of these compounds that may cause taste and odour problems in

fish tissue. This study attempted to establish threshold values for the human perception of taste and odour for representative chemical compounds identified as possibly being responsible for off-flavours in fish flesh. Values were subjectively determined for each chemical through controlled experiments using trained laboratory taste panelists. The corresponding concentrations of each chemical in the fish tissue was objectively determined utilizing gas chromatography.

Contractor: Dr. Steve Hrudey (Department of Civil Engineering, University of Alberta)

Funding: $23 900.00

PUBLICATIONS

Allen, E.A.D. 1987. An investigation into the use of biological agents for the control of aquatic plant growth in irrigation systems in Alberta. Prep. for Research Management Division, Alberta Environment. RMD Report 87/40. 26 pp.

Baddaloo, E.G., ed. 1986. Proceedings of Alberta Oil Sands Tailings Wastewater Treatment Technology Workshop. Held at Mildred Lake Research Station, Fort McMurray, Alberta; 1985 October 29-30. Prep. for Research Management Division, Alberta Environment. RMD Report 86/38. 129 pp.

Baddaloo, E.G. and D. Reid. 1987. A preliminary investigation into the use of spikerush (Eleocharis acicularis) for aquatic plant management in Alberta irrigation canals. Presented at the Applied Aquatic Workshop; 1987 February 16-18. University of Alberta. 20 pp.

Okazawa, N. and E. Peake. 1986. The persistence and movement of contaminants from heavy oil recovery. An interim report prepared for Research Management Division, Alberta Environment. 69 pp.

ENVIRONMENTAL CONTAMINANTS RESEARCH PROGRAM COMMITTEES

Departmental

Athabasca Water Quality Planning Committee

Departmental Committee on Acid Deposition (DCAD)

Program Planning Committee

Pulp and Paper Mill Effluent Committee

Water Subprogram Committee

Water Treatment and Waste Management Program Planning Committee

Interagency/Interdepartmental

Applied Aquatic Studies Workshop Committee

Canadian Annual Aquatic Toxicity Workshop Steering Committee

Decommissioning Workshop Committee

Federal-Provincial Phosphogypsum Waste Management Committee

Industrial Site Reclamation and Decommissioning Committee

Oil Sands Tailings Pond Steering Committee

ENVIRONMENTAL EMERGENCIES AND RISK ASSESSMENT RESEARCH SUB-PROGRAM

The uncontrolled release of environmental pollutants presents a serious concern to the public. The Environmental Emergencies and Risk Assessment Research Sub-program will identify departmental research needs to minimize possible emergency situations and provide a means for identifying, analyzing, intepreting, and evaluating all significant risks within Alberta.

The Environmental Emergencies and Risk Assessment Sub-Program is associated with certain main components of the departmental research programs (i.e., Acid Deposition, Environmental Contaminants, Water Treatment and Waste Management, Air Quality and Climate, and to a lesser extent, Water Resources and Biophysical Resources). The department's budget is not sufficient to devote an entire program to environmental emergencies and risk assessment but this area of research will be regarded as a sub-program with research developed according to prioritized needs. Identification of research needs will originate from: (a) the department; (b) ongoing activity in the provincial and federal governments; (c) independent agencies, including industry; and (d) public and media concerns.

Although there appears to be an agreement among certain scientific disciplines as to the methodology and limitations of risk assessment, there has been extensive debate over the reliability of earlier scientific findings in recent years. Experts in the area of risk assessment related to human health have difficulties in reaching an agreement on safe standards for well-known substances. Hence, the balance of the sub-program requires the scoping of the human health aspects of risk analysis, standard setting, and environmental emergencies research, before any other research is undertaken in this area.

There were no projects under this program in 1986/87 and no publications.

ENVIRONMENTAL INFORMATION RESEARCH SUB-PROGRAM

Environmental information is associated with all the main departmental research programs, therefore, this area of research is not perceived to stand on its own. The area of environmental information will be considered a sub-program of main programs, with research developed according to prioritized needs. This will allow for more efficient and effective use of funds to achieve departmental needs.

The process by which physical environmental problems become public issues is complex and not fully understood. It is known that the process of change involves many factors, the particular combination and interaction of which may produce effects of various magnitude and intensity. It is also known that the relationship between the magnitude of a physical environmental problem and its perception by the public is not a linear one. A serious physical environmental problem may not be perceived as such, while an event without negative environmental consequences may escalate into a serious environmental issue in the perception of the public.

A comprehensive, systematic review of studies in several disciplines will be undertaken in 1987/88 and will facilitate the systematic evaluation of all research into environmental attitudes.

There were no projects funded under this sub-program in 1986/87.

ENVIRONMENTAL EMERGENCIES, RISK ASSESSMENT, AND INFORMATION RESEARCH SUB-PROGRAMS COMMITTEES

Departmental

Departmental Committee on Acid Deposition (DCAD)

Departmental/Interdepartmental

Alberta Environmental Research Trust Grants Advisory Committee (AERT-GAC)

Alberta Government/Industry Acid Deposition Research Program (AGIADRP) Human Health Committee

Alberta Government/Industry Acid Deposition Research Program (AGIADRP) Medical Diagnostic Review Project Committee

Innalation Toxicology Program Committee (AEC)

Kananaskis Centre Policy Advisory Committee (University of Calgary)

Statistics Coordinating Committee Support Group (Alberta Bureau of Statistics)

WATER RESOURCES RESEARCH PROGRAM

The Water Resources Research Program is designed to study environmental trends and to evaluate conditions in groundwater and surface water. Results of the research will provide scientific support for developing guidelines and regulations for water resources use, and input into the management decision making process.

Of significance are the jointly funded research projects with the Alberta Research Council: the Hydrogeology of the Cold Lake Area, and the Cooperative Program in Surface Water Engineering.

PROJECTS

Atlas of Alberta Lakes

An atlas of Alberta lakes is being put together, combining existing data on more than a hundred lakes and reservoirs in Alberta. Data on geography, hydrology, surrounding land use, water chemistry, zoology and fisheries will be summarized. This data is presently spread out over various department offices and institutions, therefore, it is very difficult to obtain comprehensive information on a particular lake.

Contractor: Dr. E. Prepas, Department of Zoology, University of Alberta

Funding: $10 000.00

Control of Irrigation Return Flows in Southern Alberta

This project is studying the sensitivity of irrigation return flow rates to several irrigation canal design and operation parameters. A computer model, designed by the contractor is used to investigate factors such as: shape, slope, condition, design capacity of canals, number of depth control structures, seepage rates, flow rates, operation and type of control structures, and number of delivery points.

Contractor: Dr. D. Manz, Department of Civil Engineering, University of Alberta

Funding: $5500.00

Cooperative Program in Surface Water Engineering

The program encompasses research projects in fluvial mechanics of river engineering, erosion and scouring, sediment yield studies, freeze-up and break-up of rivers. These projects are designed to investigate long term as well as randomly occurring phenomena. They are identified on the basis of their impact on public safety, protection of property, or a defined need for information to be used for the design of hydraulic structures. Information derived from the program is also used for enforcement of the Water Resources Act and Regulations.

The five projects in this program address research priorities identified by the River Engineering Branch, Hydrology Branch, and Flow Forecast Centre of the Technical Services Division of Alberta Environment. These priorities are:

1. Scour surveys and river bed processes at stream crossings;
2. River bank protection;
3. Study of conesive materials;
4. Gauge surveys and river data base development; and
5. Ice hydraulics: freeze-up and break-up processes of streams.

Contractor: Dr. B. Shields and Dr. R.A. Harrington, Civil Engineering Department, Alberta Research Council

Funding: $150 000.00 (Research Management Division)

Examination of the Multiple Use Principle in Water Management

The multi-purpose use principle, as it pertains to water management, embodies such aspects as preferential usage, water rights, pollution control and recreation. This study will examine the man-made environments in Southern Alberta, namely reservoirs, dams, weirs and the alterations of flow as a result of their construction.

Contractor: Dr. D. Thompson, Faculty of Environmental Design, University of Calgary

Funding: $4000.00

Flatland Hydrology Simulation Model

In this graduate student project, a model is being developed that will include a spatially varied soil moisture budget for a flatland watershed.

The concepts of potential and actual contributing areas will be used to determine depression storage losses, thereby allowing more accurate determination of the excess rainfall that will convert into runoff.

Contractor: Dr. J.P. Verschuren, Department of Civil Engineering, University of Alberta

Funding: $6300.00

Flow and Shear Stress in Curved Channels

Tnis research project is directed toward the development of design criteria for bank protection works on curved channels. Criteria related to the starting and ending points of the protection and the longitudinal variation of velocity and shear stress applied within the works are to be established for circular bends of limited length. Once results are implemented in future riverbank protection schemes, savings in costs will be significant.

Contractor: Dr. P. Steffler, Department of Civil Engineering, University of Alberta

Funding: $25 000.00

Hydrogeology of the Cold Lake Study Area

The first phases of this study have shown that the regional groundwater flow regime has a northeasterly trend. Therefore, the study area was expanded to the east to include adjacent areas of Saskatchewan, and to the south to incorporate major operations in that area as well. The hydrogeological formations have been evaluated and their hydraulic properties have been determined. Modelling of deepwell injection was initiated to assess allowable flow rates, pressures and volumes of wastes and their effects on the receiving formations.

Contractor: Dr. B. Hitchon, Basin Analysis Group
Alberta Research Council

Funding: $400 000.00 (Jointly funded by Alberta Environment and Alberta Research Council)

Monitoring Groundwater Contribution to Water and Nutrient Budgets of Aquatic Systems in Alberta

The purpose of this study is to develop methods and strategies for measuring groundwater-lake flux. In particular, the use of inexpensive, in situ methods (seepage meters and mini piezometers) are tested.

Techniques to assist lake managers in estimating seepage more efficiently are also being developed.

Contractor: Dr. E. Prepas and Mr. R. Snaw, Department of Zoology, University of Alberta
Funding: $20 000.00

Seepage and Soil Salinity Relationships along Irrigation Canals

The relationship between physical, hydraulic and operational characteristics of irrigation conveyance systems, and the groundwater and salinity conditions are investigated. Development of a methodology to simulate groundwater seepage and salinization processes and to adopt for use with the Irrigation Conveyance System Simulation Program is undertaken.
Contractor: Dr. D. Manz, Department of Civil Engineering, University of Alberta
Funding: $18 000.00

Snowmelt Infiltration into Frozen Prairie Soils

The objective of this study is the development of a mechanism to predict the volume of snowmelt and its effects on soil moisture and surface runoff in the prairie regions. The first phases have enabled a computer modelling capability of snowmelt infiltration into frozen prairie soils to predict soil moisture conditions in early spring. This phase includes the development and performance evaluation of an energy budget snowmelt model.
Contractor: Dr. D.M. Gray, Division of Hydrology, University of Saskatchewan
Funding: $30 000.00

PUBLICATIONS

Conlin, B.H. and F.B. Claridge. 1986. An evaluation of the effects of brine on a compacted clay till liner. Prep. for Research Management Division, Alberta Environment by Komex Consultants Ltd. RMD Report L-92. 158 pp.

Peggs, I.D. and D. Little. 1986. Development of a procedure to nondestructively evaluate the fusion quality of geomembrane seams. Prep. for Research Management Division, Alberta Environment by Hanson Materials Engineering. RMD Report L-93. 77 pp.

WATER RESOURCES RESEARCH PROGRAM COMMITTEES

Departmental

Program Planning Committee for Water Resources Research Program

Water Subprogram Committee

Interagency/Interdepartmental

Alberta Environmental Research Trust - Grants Advisory Committee (GAC)

Alberta Fishways (Alberta Environment, Alberta Energy and Natural Resources, Alberta Transportation, and Environment Canada)

Alberta Geological Survey Review Committee

Alberta Research Council Surface Water Committee

Alberta Watershed Research Program (AWRP)

Cold Lake Hydrogeochemistry Steering Committee

Cold Lake Hydrogeology Steering Committee

Mountains and Foothills Reclamation Research Program (MFRRP) - Hydrology Subcommittee

Panel for Energy Research and Development

Plains Coal Reclamation Research - Geochemistry Subcommittee

Seminar Speaker Selection Committee

Steering Committee on Cooperative Program in Surface Water Engineering

WATER TREATMENT AND WASTE MANAGEMENT RESEARCH PROGRAM

The objectives of the program are tied to Departmental policy and to concerns of the public and the scientific community. In general, the program is designed to provide information on, and solutions to, priority issues identified at public hearings, workshops, or by the department.

The program objectives can be described in broad terms as follows:

1. To scope and prioritize water treatment and waste management research areas;
2. To provide a mechanism for co-ordination of all water treatment and waste management research in Alberta;
3. To encourage the development of water treatment and waste management research expertise both within the government and in the province as a whole; and
4. To encourage cross-media and multi-disciplinary approaches to water treatment and waste management research.

Projects undertaken in the 1986/87 FY were:

1. RMD 85-07: Water Treatment Evaluation for Giardia Cyst Reduction;
2. RMD 85-38a: Management of Effluents from Chemithermomechanical Pulp Mills;
3. RMD 85-38b: Conceptual Review of Alternative Wastewater Treatments for the CTMP Mill at Whitecourt;
4. RMD 85-30: An Analysis of the Major Environmental and Health Concerns of Phosphogypsum Tailings in Canada and Methods for their Reduction;
5. RMD 85-11b: Investigation into the Decommissioning of Phosphogypsum Tailings Ponds in Alberta; and
6. RMD 85-44: Membrane Research for Domestic Sewage Treatment.

PROJECTS

Water Treatment Evaluations for Giardia Cyst Reduction

This project is designed to continue the investigation of the occurrence and survival of human infective Giardia cysts in water, using the mobile experimental water treatment plant. This work will lead to the formulation of recommendations for minimum water treatment standards in Alberta for Giardia cyst removal and/or inactivation. Previous research has snown that it is possible to remove cysts from drinking water using conventional methods but that operating standards must be rigorously adhered to.

Work undertaken during the 1986/87 fiscal year involved assessing conventional water treatment procedures to remove and inactivate Giardia cysts using the Vegreville Centre's mobile water treatment trailer. This represented the second field season of experimentation with the mobile plant. Work specifically focussed on the use of alum as a flocculant/coagulant prior to filtration and disinfection using chlorine. The research has verified the need to maintain the multiple barrier concept of flocculation/coagulation, filtration and disinfection, as no single one is adequate to safeguard against cyst passage. Future work will investigate the effectiveness of additional filter aids through jar tests and pilot experimentation.

The Department also co-sponsored an international conference on Giardia in Calgary (February 22-25, 1987) where a wide range of topics were presented, from detection and differentiation of cysts to water treatment aspects. Proceedings are to be produced.

Contractor: Dr. P.M. Wallis, Kananaskis Centre for Environmental Research, University of Calgary

Funding: $85 000.00

Management of Effluents from Chemithermomechanical Pulp Mills and Conceptual Review of Alternative Wastewater Treatment for the CTMP Mill at Whitecourt

Little information is available on the chemithermomechanical pulp (CTMP) mill technology and their effluents relative to chemical based pulp mills and although their effluents are purported to be more acceptable than

the common chemical variety, major concerns exist relative to suitable treatment technologies. In addition to the Millar Western CTMP mill, it is recognized that several timber areas will eventually be developed and that the most likely pulp and paper technologies to be employed would be CTMP variety. Research to support present and future CTMP applications involves four components: (1) Phase I, of a two-phase study, addresses effluent characterization, technology evaluations and potential potable water impacts; (2) a second summary document addresses recent public enquiries; (3) a background literature review is underway by RMD and SAD; and (4) Phase II, commencing July 1987, involves an assessment of water quality based impacts, definition of mixing zones, and water use scenarios.

Contractor: NovaTec and HydroQual Consultants Inc.

Funding: $35 000.00

An Analysis of Major Environmental and Health Hazards of Phosphogypsum Tailings in Canada and Methods for their Reduction

Phosphate rock is processed to produce phosphoric acid and phosphate fertilizers. Phosphogypsum is a major by-product and contains significant quantities of uranium and radon. Concerns about environmental and health hazards regarding radon emanation from tailings piles has restricted development near one processing site in the Calgary vicinity. Radon gas, a product of uranium decay, is a primary concern in its influence on air quality in the vicinity of the waste gypsum stockpile. There are also no close-out criteria for the phosphogypsum piles. This study is intended to identify the environmental and health hazards associated with phosphogypsum tailings, scope their magnitude and recommend methods for their long-term amelioration. The study will assist in the development of national guidelines for disposal of phosphogypsum wastes. This is an $80 000.00 multi-funded (Alberta Environment, Environment Canada, and Ontario Ministry of the Environment) project.

This project has been jointly managed and funded under the Water Treatment and Waste Management, and Environmental Contaminants Program of Research Management Division.

Contractor: Senes Consultants Ltd., Willowdale, Ontario

Funding: $25 000.00

An Investigation into the Decommissioning of Phosphogypsum Tailings Ponds in Alberta

The environmental concerns associated with phosphogypsum tailings ponds challenge the decommissioning process. The contamination of land and the large volumes of by-product gypsum present influence the options for a suitable end use. Several Alberta phosphate fertilizer plants contain tailings ponds over 50 hectares in size. With the possibility of these areas reverting to an alternate land use in the future, a multi-government study (RMD 85-30) investigating radon emanation from phosphogypsum tailings has been undertaken. The objective of this study (RMD 85-11B) is: (1) to obtain background information on the environmental aspects of phosphogypsum ponds; and (2) to recommend a preliminary plan for site assessment and investigation of an Alberta phosphogypsum pond.

This project has been jointly managed and funded under the Water Treatment and Waste Management, and Environmental Contaminants programs.
Contractor: Mr. Glen Norlander and Dr. Dixon Thompson, University of Calgary
Funding: $15 000.00

Membrane Research for Domestic Sewage Treatment

The objective of this project is to evaluate, through literature reviews and bench pilot testing, the potential application of crossflow microfiltration and reverse osmosis techniques to wastewater treatment at the Bonnybrook Sewage Treatment Plant.
Contractor: Dr. L. Gramms, Separ Systems and Research Ltd.
Funding: $25 000.00

PUBLICATIONS

Freeman, J.T. and R.P. Innes. In prep. Enhanced microbial decomposition of hydrocarbons in the unsaturated zone - a feasibility study. Prep. for Research Management Division, Alberta Environment by Stanley Associates Engineering Ltd.

Gramms, L.C. and D.R. Hagen. In prep. Membrane research for domestic sewage treatment. Prep. for Research Management Division, Alberta Environment by Separ Systems and Research Ltd.

Hamilton, H. In prep. Aquatic fate of fish tainting compounds in the Athabasca River. Prep. for Research Management Division, Alberta Environment by HydroQual Consultants Inc. and Dominion Ecological Ltd., Calgary, Alberta.

Hargesheimer, E., G.A. Irvine, A. Badakhshan, and R.T. Seidner. 1986. Pilot studies into the effects of disinfection strategies on drinking water quality. IN: Proceedings of the 2nd National Conference on Drinking Water. P. Huck and P. Toft, eds. Edmonton, Alberta.

Hrudey, S.E. In prep. Review of oil sands tailings pond contaminants with fish tainting potential. Prep. for Research Management Division, Alberta Environment by Steve Hrudey and Associates Ltd.

Innes, B. 1987. Bioreclamation of deep soils. Conference presentation: 24th Annual Alberta Soil Science Workshop. 1987 February 16-18, Calgary, Alberta.

Irvine, G.A. 1986. Pilot plant studies in the use of ozone for domestic water treatment. Prep. for Research Management Division, Alberta Environment by Department of Chemical and Petroleum Engineering, University of Calgary. RMD Memorandum Report #2. 362 pp.

Irvine, G.A., A. Badakhshan, and C.M. Lewis. 1986. Operational criteria for pilot plant studies for the control of organic contaminants. IN: Proceedings of the 2nd National Conference on Drinking Water. P. Huck and P. Toft, eds. Edmonton, Alberta.

Irvine, G.A., A. Badakhshan, and E. Hargesheimer. 1985a. Design of pilot plant studies for testing alternative water treatment methods. IN: Proceedings of the 31st Conference of the Canadian Association for Chemical Engineering. Calgary, Alberta. pp. 330-335.

Irvine, G.A., A. Badakhshan, and E. Hargesheimer. 1985b. A pre-ozonation treatment to reduce trihalomethanes in the City of Calgary's drinking water. Presented at the 68th Conference of the Canadian Institute of Chemistry, Queens University: Kingston, Ontario.

Irvine, G.A., A. Badakhshan, E. Hargesheimer, and C.M. Lewis. In prep. Monitoring heterotrophic bacterial populations during drinking water treatment ozonation. Submitted to Journal for the Association of Water Pollution Research and Control.

Jardine, C. and S.E. Hrudey. 1987. Threshold values for potential fish tainting substances from oil sands wastewaters. Presented at the 2nd International Symposium on Off-Flavours in the Aquatic Environment, Japan, October 1987.

Konig, W. 1987. Fish tainting potential of selected oil sands extraction tailings pond wastewaters. Presented at Applied Aquatics Workshop, University of Alberta, February 1987.

Mackenzie, I.B. and J.R. Marsh. In prep. Departmental overview of pulping technology and wastewater quality/treatment. Prep. for Research Management Division, Alberta Environment.

Marsh, J. and C. Dykstra. In prep. A study to identify inventory control procedures at commercial service stations in the Edmonton area. Prep. for Research Management Division, Alberta Environment by Sereda, Marsh & Associates Ltd.

McClure, S. and I.B. Mackenzie. 1987. A regulatory agency's experience with Giardia. Presented at the Calgary Giardia Conference. 1987 February 23-25, Calgary, Alberta.

Norlander, G. In prep. A preliminary investigation into the decommissioning of phosphogypsum tailings pond in Alberta. Prep. for Research Management Division, Alberta Environment by the University of Calgary.

Senes Consultants Ltd. In prep. An analysis of the major environmental and health concerns of phosphogypsum tailings in Canada and methods for their reduction. Prep. for Low-Level Radioactive Waste Management Office, Ontario Ministry of the Environment, Alberta Environment, and Environment Canada.

Turk, S. and H. Hamilton. In prep. Conceptual review of alternative wastewater treatment for the CTMP at Whitecourt. Prep. for Research Management Division, Alberta Environment by NovaTec Consultants Ltd. and HydroQual Consultants Inc.

Turk, S. and H. Hamilton. In prep. Management of effluents from chemithermo-mechanical pulp mills. Prep. for Research Management Division, Alberta Environment by NovaTec Consultants Ltd. and HydroQual Consultants Inc.

Wallis, P.M. In prep. Giardia research. Prep. for Research Management Division, Alberta Environment by Kananaskis Centre for Environmental Research, University of Calgary.

Wallis, P.M. 1986. Reservoirs and transmission of Giardiasis in the environment. Prep. for Research Management Division, Alberta Environment by Kananaskis Centre for Environmental Research, University of Calgary.

Wallis, P.M. and J.M. Buchanan-Mappin. 1984. Detection of Giardia cysts at low concentrations in water using Nuclepore membranes. Wat. Res. 19:331-334.

Wallis, P.M. and H.M. Wallis. 1986. Excystation and culturing of human and animal Giardia spp. by using gerbils and TYI-S-33 medium. Appl. Environ. Microbiol. 51:647-651.

Wallis, P.M., R.M. Zammuto, and J.M. Buchanan-Mappin. 1986. Cysts of Giardia spp. in mammals and surface waters in southwestern Alberta. J. Inf. Dis. 22:115-118.

Wallis, P.M., J.M. Buchanan-Mappin, J.M. Faubert, and M. Belosevic. 1984. Reservoirs of Giardia spp. in southwestern Alberta. J. Wildlife Dis. 20:279-283.

WATER TREATMENT AND WASTE MANAGEMENT COMMITTEES

Departmental

Athabasca Water Quality Planning Committee

Pulp and Paper Mill Effluent Committee

Water Treatment and Waste Management Program Planning Committee

Interagency/Interdepartmental

Canadian Council for Resources and Environment Ministers (CCREM) Working Group on Water Pollution Control

Federal/Provincial Phosphogypsum Waste Management Committee

Giardia Workshop Committee

Industrial Site Reclamation and Decommissioning Committee

Oil Sands Tailings Pond Steering Committee

Sour Gas Flaring Committee